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DESCRIPTION

SEMICONDUCTOR DEVICE AND METHOD FOR ASSEMBLING THE SAME

Technical Field

The present invention relates to a highly reliable semiconductor device and an assembling method thereof.

Background Art

As a structure for mounting a semiconductor device that is made of a packaged semiconductor element on a circuit board, a structure in which a projected electrode such as a solder bump formed on a semiconductor device is bonded to a base plate is known. In a semiconductor device having such a structure, an attempt to make a semiconductor device as thin as possible, that is, 150 μm or less is in progress. This intends, by reducing stress during the heat cycle, to realize high bonding reliability after the mounting. That is, when an environment temperature varies after the mounting, owing to difference of thermal expansion coefficients of a semiconductor and a work, at a bonding portion of the semiconductor element and a solder bump, stress is generated. By making the semiconductor element thinner, the stress is intended to reduce.

A mounting structure that is formed of such a thinned semiconductor element will be explained with reference to the

ATTACHMENT B

drawings. Fig. 11A is a sectional view of an existing mounting structure and Fig. 11B is a diagram showing a deformed state of a semiconductor device in an existing mounting structure. In Fig. 11A, on base plate 10, semiconductor device 1 is mounted, and to electrode 10a formed on a top surface of base plate 10, bump 3 that is disposed on a circuit formation surface of semiconductor element 2 with solder as a formation material is bonded. Semiconductor element 2, as mentioned above, is made thinner with an intention of suppressing the stress generated at a bonding portion of the semiconductor element and the bump as small as possible.

Fig. 11B shows a state where in a mounting structure in which semiconductor device 1 having such thinned semiconductor element 2 is mounted on base plate 10, thermal contraction stress is generated in reflowed base plate 10. Since semiconductor element 2 is thinned and flexible, in accordance with the contraction deformation of base plate 10, semiconductor element 2 deforms accordingly. In a mounting structure where after forwarding the thinning semiconductor element 2 having a thickness of 150 μm or less is used, the deflection deformation of semiconductor element 2 shows a deflection shape (part shown with an arrow mark P1) in which semiconductor element 2 is concaved between respective bumps 3; that is, as the thinning goes further, the more excellent traceability can be realized. It is demonstrated that thereby, a level of the stress generated

at a bonding portion of semiconductor element 2 and bump 3 can be effectively reduced.

However, in a mounting structure made of thinned semiconductor element 2, disadvantages shown below are confirmed empirically and according to numerical analysis. As shown in Fig. 11B, the deflection of semiconductor element 2 (shown with an arrow mark P2) rapidly increases outside bump 3 at the outermost periphery. Accordingly, in some cases, there is caused a phenomenon in that in the neighborhood of outermost periphery bump 3, in the neighborhood of the outside of bump 3, a crack is generated on a bottom surface of semiconductor element 2, and semiconductor element 2 is broken from the crack. That is, there is a problem in that as the semiconductor element is made thinner, while the stress generated in the solder bump is lowered, the neighborhood of the outer periphery of the semiconductor element is locally broken.

Disclosure of the Invention

The present invention intends to provide a semiconductor device that, in a semiconductor device including a thinned semiconductor element, can inhibit a semiconductor element from being broken in the neighborhood of an outer periphery portion and thereby secure the reliability.

In order to realize the above object, a semiconductor device according to the present invention is a semiconductor

device in which on a rear surface of a semiconductor element on a front surface of which a plurality of external connection terminals is formed, a integrated body higher in the rigidity than the semiconductor element is adhered with a resin binder, wherein an outer shape of the integrated body is made larger than that of the semiconductor element and a side face of the semiconductor element is covered with the resin binder to reinforce a periphery of the semiconductor element.

Brief Description of the Drawings

Fig. 1A is a perspective view of a semiconductor device according to embodiment 1 of the present invention.

Fig. 1B is a partial sectional view of a semiconductor device according to embodiment 1 of the invention.

Figs. 2A through 2E are diagrams for explaining steps of an assembling method of a semiconductor device according to embodiment 1 of the invention.

Fig. 3 is a perspective view of a plate member that is used in a semiconductor device according to embodiment 1 of the invention.

Fig. 4 is a perspective view of an electronic component mounting device that is used in assembling a semiconductor device according to embodiment 1 of the invention.

Fig. 5 is a perspective view of a dicing machine that is used in assembling a semiconductor device according to

embodiment 1 of the invention.

Fig. 6 is a partial sectional view of a dicing machine that is used in assembling a semiconductor device according to embodiment 1 of the invention.

Fig. 7A is a sectional view of a mounting structure according to embodiment 1 of the invention.

Fig. 7B is a partial sectional view of a mounting structure according to embodiment 1 of the invention.

Fig. 8A is a perspective view of a semiconductor device according to embodiment 1 of the invention.

Fig. 8B is a plan view of a semiconductor device according to embodiment 1 of the invention.

Figs. 9A through 9D are diagrams for explaining steps of an assembling method of a semiconductor device according to embodiment 2 of the invention.

Fig. 10A is a perspective view of a semiconductor device according to embodiment 3 of the invention.

Fig. 10B is a partial sectional view of a semiconductor device according to embodiment 3 of the invention.

Fig. 11A is a sectional view of an existing mounting structure.

Fig. 11B is a diagram showing a deformation state of a semiconductor device in an existing mounting structure.

Best Mode for Carrying Out the Invention

(Embodiment 1)

With reference to Figs. 1A and 1B, a semiconductor device will be explained. In Figs. 1A and 1B, semiconductor device 1 has a configuration in which on a rear surface (that is, second surface) of semiconductor element 2 plate 4 (integrated body) is adhered with resin binder 5 and, on a plurality of electrodes 2a that are external connection terminals formed along a periphery of a surface (that is, first surface) of semiconductor element 2, bumps 3 are formed.

Semiconductor element 2 here is in a state thinned by a method such as mechanical polishing or etching. In general, in a state where a semiconductor element is mounted on a base plate through bumps, the smaller a thickness of the semiconductor element is, the more excellent the reliability of the bonding after mounting is. This is because even when owing to difference of stresses of semiconductor element 2 and a base plate the stresses try to concentrate at a bonding portion of bump 3, owing to generation of deformation (deflection) in a thickness direction of semiconductor element 2 itself, the stress is dispersed. Accordingly, in the present embodiment, as mentioned above, semiconductor element 2 is thinned so as to have a thickness t1 in the range of 10 to 150 μm, and thereby semiconductor element 2 is allowed to deform (deflect) in a thickness direction.

In the thinning, a surface opposite to a circuit formation

surface (first surface) of semiconductor element 2 is roughly processed by means of mechanical polishing with a grinding stone or the like followed by applying a finishing process by means of dry etching or wet etching with a chemical. When the mechanical polishing is applied, on a rear surface a damaged layer including many micro-cracks is formed. The damaged layer causes a decrease in the flexural strength of the semiconductor element. However, when the damaged layer is removed by the finishing, the flexural strength of semiconductor element 2 can be increased.

Plate 4 makes easy to stably hold semiconductor device 1 in handling such as the mounting of semiconductor device 1 and has a function of protecting semiconductor device 1 that is mounted on a base plate or the like from an external force. Accordingly, as plate 4, one in which a structural material such as metal, ceramics or resin is processed into a shape that satisfies the above function, that is, a thickness t2 having the rigidity higher than semiconductor element 2 and an external shape larger than an external shape of semiconductor element 2 is used.

For resin binder 5 that adheres semiconductor element 2 with plate 4, a material that has low elastic coefficient and is deformable is used. Thereby, while semiconductor element 2 is allowed to deform by a necessary amount in a thickness direction, semiconductor element 2 can be adhered to plate 4.

That is, in a state where semiconductor device 1 is mounted on a base plate, semiconductor element 2 can deform following the deformation of the base plate.

As shown in Fig. 1, resin binder 5 is formed stuck out of an edge of element 2 over an entire circumference of semiconductor element 2. Stuck out resin binder 5a creeps up along side face 2b of semiconductor element 2 to form a shape that at least partially covers side face 2b. It is not necessarily required to cover an entire surface in a thickness direction of side face 2b; however, an edge on a side of plate 4 is covered. The edge on a side of plate 4 is formed with a second surface of semiconductor device 1 and side face 2b. Thus, resin binder 5a that covers side face 2b works as a reinforcement that reinforces a periphery of semiconductor element 2.

At a periphery portion of semiconductor element 2, a fine crack generated when a semiconductor wafer is diced and individual semiconductor elements 2 are cut out is likely to remain as it is, and in some cases damage is generated from this crack. Resin binder 5a that covers side face 2b has an effect of reinforcing a periphery portion containing such fine crack. Furthermore, as mentioned below, in a state where semiconductor device 1 is mounted on base plate 10, it has a function of inhibiting semiconductor element 2 from excessively deforming owing to stress generated by difference of thermal

deformations of base plate 10 and semiconductor element 2 (Figs. 7A and 7B).

In the next place, with reference to Figs. 2A through 2E, a method of assembling semiconductor device 1 will be explained.

In Fig. 2A, plate member 6 is an intermediate component before plates 4 that constitute part of semiconductor device 1 are cut off. As shown in Fig. 3, on a top surface of plate member 6, raised partitions 6a protruded in lattice are disposed, and each of recess portions 6b surrounded by raised partitions 6a is a semiconductor element adhesion region to which semiconductor element 2 is adhered. Raised partitions 6a have a function as a dam that inhibits, when, as mentioned below, resin binder 5 for adhering semiconductor element 2 is coated in recess portion 6b, resin binder 5 from overflowing the semiconductor adhesion region and spreading into the surrounding.

On a position corresponding to raised partitions 6a of a bottom surface of plate member 6, groove portions 6c are formed. Groove portions 6c are formed by cutting grooves in lattice from a bottom surface side of plate member 6 that has a thickness t4 and form thin-wall portions of which thickness t3 is smaller than t4. The thin-wall portions coincide with cutting places when plate 4 is separated from plate member 6.

In the next place, as shown in Fig. 2B, into respective

recess portions 6b of plate member 6 dispenser 7 supplies resin binder 5 for adhering semiconductor element 2 (first+ step). At the coating of resin binder 5, owing to the disposition of raised partitions 6a as a dam portion in the surroundings of recess portions 6b, resin binder 5 can be inhibited from overflowing the semiconductor adhesion region and spreading into the surrounding.

Furthermore, at the coating, dispenser 7 is controlled so as to discharge an appropriate coating amount of resin binder 5 necessary for covering side face 2b of semiconductor element 2 when resin binder 5 that is pressed down by semiconductor element 2 after the coating sticks out of an edge portion of semiconductor element 2.

Thereafter, plate member 6 to which resin binder 5 is supplied is transferred to a second step for adhering a semiconductor element. In the second step, as shown in Figs. 2C and 2D, the semiconductor elements 2 are each mounted on resin binder 5 that is coated on the plate member 6 (mounting step), followed by heating resin binder 5 (heating step) to cure resin binder 5, and thereby rear surface sides of a plurality of semiconductor elements 2 are adhered to respective recesses 6b of plate member 6 in an arranged manner with resin binder 5.

Electronic component mounting apparatus that is used for mounting semiconductor elements 2 in the mounting step will

be explained with reference to Fig. 4. In Fig. 4, on supply table 11, adhesive sheet 12 to which semiconductor elements 2 are adhered in lattice is mounted. Below supply table 11, semiconductor separating mechanism 13 is disposed. When semiconductor separating mechanism 13 is driven by use of semiconductor separating mechanism driver 14, ejector pin unit 13a pushes up a bottom surface of adhesive sheet 12. Thereby, semiconductor element 2 is peeled off a top surface of adhesive sheet 12 and picked up by means of mounting head 16.

On a lateral side of supply table 11, base plate holder 15 is disposed, and on base plate holder 15 resin binder supplied plate member 6 is held. Above supply table 11 and base plate holder 15, mounting head 16 that is driven by means of mounting head actuator 19 is disposed. Mounting head 16 is provided with suction nozzle 8, picks up semiconductor element 2 from adhesive sheet 12 and mounts on plate member 6 on base plate holder 15.

Camera 17 grounded above supply table 11 takes an image of semiconductor element 2 adhered to adhesive sheet 12. An image taken with camera 17 undergoes recognition processing at semiconductor recognition unit 20 to recognize a position of semiconductor element 2 in adhesive sheet 12. A result of position recognition is sent to control unit 21 and as well to semiconductor separating mechanism driver 14. Control unit 21, based on the result of position recognition, controls

mounting head actuator 19, and thereby, when mounting head 16 picks up semiconductor element 2, suction nozzle 8 and ejector pin unit 13a are aligned with semiconductor element 2 that is a target of picking up.

Camera 18 disposed above base plate holder 15 takes an image of plate member 6 held by base plate holder 15. An image taken with camera 18 undergoes recognition processing at mounting position recognition unit 22 to detect a semiconductor element mounting position in plate member 6. A result of position recognition is sent to control unit 21. Control unit 21, based on the result of position recognition, controls mounting head actuator 19, and thereby, when mounting head 16 mounts semiconductor element 2, semiconductor element 2 held by suction nozzle 8 is aligned with a detected mounting position.

When semiconductor element 2 is mounted on plate member 6 by use of the electronic component mounting apparatus, as shown in Fig. 2C, a front surface (first surface) side on which bump 3 of semiconductor element 2 is formed is sucked and held by means of suction nozzle 8 and a rear surface (second surface) of semiconductor element 2 is pushed down on resin binder 5. At this time, in accordance with an amount of resin binder 5 coated, a pressing height due to suction nozzle 8 is controlled, and thereby resin binder 5 stuck outside of a periphery portion (portion shown with an arrow mark P3) of respective semiconductor elements 2 is made so as to creep up side face 2b of semiconductor

element 2 and cover side face 2b (resin binder 5a shown in Fig. 1B). At this time, as long as an edge portion of the rear surface side of semiconductor element 2 where at the dicing damage tends to remain is completely covered and reinforced, side face 2b may be completely covered or partially covered.

According to the embodiment, since semiconductor elements 2 are piece by piece pressed on resin binder 5 by use of mounting head 16 and mounted, mounting load (pressing force) can be made smaller than that in the case of mounting (adhering) in a lump. Accordingly, as the electronic component mounting apparatus, a die bonder, a chip mounter and so on can be diverted.

Plate member 6 on which semiconductor elements 2 are thus mounted is transferred to a heating furnace. Heating at a predetermined temperature here cures resin binder 5 as shown in Fig. 2D. At this time, resin binder 5 stuck outside of a periphery portion of respective semiconductor elements 2, in the course of curing, temporally becomes low in the viscosity, thereby further creeps up side face 2b of semiconductor elements 2, followed by curing in this shape as it is with side face 2b covered. Thereby, after curing of resin binder 5, resin binder 5a as a reinforcement shown in Fig. 1B is formed. Thereby, the second step comes to completion.

In the embodiment, after semiconductor elements 2 are mounted, plate member 6 is transferred to the heating furnace to cure resin binder 5; however, by use of mounting head 16

that incorporates heating means, semiconductor elements 2 may be heated while mounting.

That is, by use of the heating means incorporated in mounting head 16, suction nozzle 8 that holds semiconductor elements 2 may be heated and heat may be transferred through suction nozzle 8 and semiconductor elements 2 to heat resin binder 5. Furthermore, a heating coil or the like wired from mounting head 16 may be disposed in the surroundings of suction nozzle 8 to directly heat suction nozzle 8. That is, when the mounting means made of mounting head 16 and suction nozzle 8 are provided with heating means, mounting step and heating step can be simultaneously carried out.

In the case of heating being carried out with mounting head 16, the dedicated heating step shown in Fig. 2D may be omitted, and, when thus carrying out, there is an advantage that by omitting the heating furnace apparatus can be simplified. However, in this case, since a tact time of mounting head 16 is restricted by a curing time, total productivity is lowered than that in a case where the mounting step and the heating step are separately performed. Furthermore, in the embodiment, an example where, as resin binder 5, a thermosetting resin is used is shown. However, instead of this, a thermoplastic resin may be used.

Plate member 6 where resin binder 5 is cured thus is transferred to a cutting step, here, as shown in Fig. 2E, plate

member 6 to which semiconductor elements 2 are adhered is cut at cutting positions between adjacent semiconductor elements 2 by use of cutting blade 24a (third step). Thereby, plate member 6 is cut and separated into plates 4 for individual semiconductor elements 2, and thereby assembly of semiconductor devices 1 comes to completion.

The cutting step will be explained with reference to Figs. 5 and 6. Fig. 5 shows a dicing machine that is used in the cutting. On a top surface of plate fixing table 23, plate member 6 on which semiconductor elements 2 are mounted followed by curing resin is disposed. Above the plate fixing table 23, cutting head 24 with cutting blade 24a is disposed, and, by moving cutting head 24 in a X-direction or Y-direction with cutting blade 24a rotating, plate member 6 is cut along cutting positions in accordance with grooves 6c.

As shown in Fig. 6, on a top surface of the plate fixing table 23, for each of positions corresponding to semiconductor elements 2 on plate member 6, suctioning retainer 25 is disposed, and on a top surface of suctioning retainer 25 suctioning groove 25a is formed. Suctioning groove 25a is communicated with suctioning hole 23a disposed inside of plate fixing table 23, and suctioning hole 23a is further connected to vacuum suctioning source 26. When vacuum suctioning source 26 is driven with a bottom surface of plate member 6 abutted on suctioning retainer 25, plate member 6 is sucked and retained with suctioning

retainer 25, and thereby a position of plate member 6 is fixed.

On raised partition 6a of the plate member 6 thus fixed in a position thereof, cutting blade 24a is aligned, and when cutting blade 24a is lowered while rotating, a thin wall portion of groove 6c is cut. At this time, by use of cutting blade 24a of which blade width is smaller than a separation between adjacent semiconductor elements 2, plate member 6 is cut with a shape in which plate 4 after separation into individual pieces sticks out of an end surface of semiconductor element 2. Accordingly, in individually separated semiconductor devices 1, an external shape of plate 4 becomes larger than that of semiconductor element 2.

Furthermore, at the cutting, since grooves 6c are formed beforehand on a bottom surface, a thickness of a portion that is cut with cutting blade 24a is made smaller. Thereby, since a necessary lowering amount of cutting blade 24a in the cutting step can be made as small as possible, when the cutting blade is lowered, a tip end of the blade can be inhibited from coming into contact with plate fixing table 23 to cause damage.

In the next place, an electronic component mounting structure that is formed by mounting the above semiconductor device 1 on a base plate will be explained with reference to Figs. 7A and 7B.

As shown in Fig. 7A, semiconductor device 1 is mounted on base plate 10 when bump 3 is solder bonded and connected

to electrode 10a formed on a top surface of base plate 10. Fig. 7B shows a deformed state of semiconductor element 2 located outside of bump 3. In a structure where semiconductor element 2 that is thinned as shown in the embodiment is bonded through bump 3 to base plate 10, because of the stress generated owing to difference of thermal deformations of semiconductor element 2 and base plate 10, a range outside of bump 3 tends to deflect largely toward base plate 10. A deflected state is shown with a dotted line in Fig. 7B. Owing to the deformation, in the neighborhood of the outside of bump 3, on a bottom surface of semiconductor element 2 large surface stress is generated, and thereby, in some cases, semiconductor element 2 is damaged.

By contrast, as shown in the embodiment, in the case of semiconductor device 1 reinforced with resin binder 5a that covers side face 2b of semiconductor element 2 being mounted on base plate 10, downward deflection of semiconductor element 2 in a range outside of bump 3 at outermost periphery can be largely diminished. That is, resin binder 5a covers side face 2b of semiconductor element 2 and works so as to inhibit semiconductor element 2 from excessively deflecting. By this operation, semiconductor element 2 is inhibited from deflecting downward, and thereby semiconductor element 2 can be inhibited from being damaged owing to the deflection thereof.

Like semiconductor device 101 shown in Figs. 8A and 8B, sticking out of resin binder 5a from a periphery portion of

semiconductor element 2 is limited in a direction of diagonal line of semiconductor element 2, and thereby a reinforcement portion that covers with resin binder 5a a side face of semiconductor element 2 may be formed only at corners of semiconductor element 2. In this case, at the coating of resin binder 5 with dispenser 7 in Fig. 2B, so as to coat resin binder 5 only in a range shown in Fig. 8B, a coating trajectory of dispenser 7 is set in X-shape and a discharge amount from dispenser 7 is controlled. When a formation range of the reinforcement portion is limited thus to corner portions of semiconductor element 2, the corner portions that are most likely to be damaged in a mounting state after completion of the semiconductor device can be selectively reinforced.

(Embodiment 2)

Embodiment 2 will be explained with reference to Figs. 9A through 9D.

According to the present embodiment 2, in a first step of supplying a resin binder to a plate member, without using a dispenser, a resin binder formed beforehand in sheet is adhered.

In Fig. 9A, plate member 6A has a shape in which raised partitions 6a on a top surface of plate member 6 shown in embodiment 1 are removed, and on a bottom surface of plate member 6A similar grooves 6c are formed. On a top surface of plate member 6A, resin sheet 5A is adhered. Resin sheet 5A is one

obtained by forming a resin material similar to resin binder 5 used in embodiment 1 in sheet and is adhered to plate member 6A owing to adhesiveness of resin binder 5 itself.

Thereafter, plate member 6 to which resin sheet 5A is adhered is sent to a second step for adhering semiconductor elements. In the second step, as shown in Figs. 9B and 9C, a second surface of semiconductor element 2 is mounted on resin sheet 5A that is adhered to plate member 6 (mounting step), followed by heating resin sheet 5A (heating step) to cure a resin component of resin sheet 5A. Thereby, second surface (rear surface) sides of a plurality of semiconductor elements 2 are adhered through cured resin sheet 5A to plate member 6 in an arranged state.

In the heating step, the heating at a predetermined temperature by use of a heating furnace enables to cure the resin component in resin sheet 5A. At this time, resin binder 5 located outside of a periphery portion of respective semiconductor elements 2 becomes temporally lower in the viscosity in the course of curing to increase the fluidity, and thereby creeps up side face 2b of semiconductor element 2 owing to surface tension. When the heating is further continued, the resin component of resin sheet 5A is cured with side face 2b covered. Thereby, after the curing of resin sheet 5A, resin binder 5a as a reinforcement shown in Fig. 1B is formed. Thereby, the second step comes to completion.

Plate member 6A of which resin sheet 5A is thus completely cured is transferred to a cutting step, and here plate member 6A to which semiconductor elements 2 are adhered is cut between adjacent semiconductor elements 2 (third step). Thereby, plate member 6A is cut and separated into plates 4 for individual semiconductor elements 2, and thereby assembly of semiconductor device 1 comes to completion.

(Embodiment 3)

Subsequently, a semiconductor device according to embodiment 3 will be explained with reference to Figs. 10A and 10B.

In Fig. 10A, semiconductor device 103 is formed by adhering plate 4 (integrated body) to a rear surface (that is, second surface) of semiconductor element 30 with resin binder 5, and on a surface of semiconductor element 30 a plurality of bumps 3 is formed in lattice. As shown in Fig. 10B, semiconductor element 30 is formed by forming re-wiring layer 9 on a top surface (electrode formation surface) of semiconductor element 2A that is thinned similarly to semiconductor element 2 shown in embodiment 1.

At a periphery of a surface (that is, first surface) of semiconductor element 2A, electrodes 2a that are external connection terminals are formed, and the respective electrodes 2a are in conduction with electrodes 9a formed in the number corresponding to that of electrodes 2a on a surface of re-wiring

layer 9 through internal wirings 9b inside a re-wiring layer 9. On electrode 9a, bump 3 is formed for mounting semiconductor device 103.

In embodiment 3, by disposing re-wiring layer 9, in comparison with semiconductor device 1 shown in embodiment 1, more bumps 3 can be formed in the same projected area, that is, denser mounting is made possible. In order to assemble the semiconductor device 103, in methods of assembling semiconductor devices shown in embodiments 1 and 2, semiconductor element 2 has only to be replaced by semiconductor element 30.

Thereby, on side face 30a of semiconductor element 30, a reinforcement portion in which stuck out resin binder 5a covers side face 30a is formed. In semiconductor device 103 thus configured, by forming the reinforcement portion where side face 30a of semiconductor element 30 is covered, as mentioned above, the flexural deformation generated at a periphery portion of semiconductor element 30 after mounting is inhibited from occurring, and thereby internal wirings 9b inside rewiring-layer 9 can be inhibited from being disconnected.

In the above-explained embodiments, when commercially available epoxy resin, acrylic resin, urethane resin and silicone resin are used as the resin, a similar effect can be obtained. However, the present invention is not restricted to these resins.

Industrial Applicability

A semiconductor device according to the present invention has a configuration where an outer shape of an integrated body that is adhered through a resin binder to a semiconductor device is made larger than that of the semiconductor device, and the resin binder is made so as to cover a side face of the semiconductor element to form a reinforcement portion for reinforcing a periphery of the semiconductor element. Accordingly, the semiconductor element can inhibit damage from occurring in the neighborhood of an outer periphery, and thereby the reliability after the mounting can be secured.

Furthermore, an assembling method includes a step of supplying a resin binder to a plate member that is an integrated body, a step of adhering rear surface sides of the semiconductor elements to the plate member in an arranged manner, and a step of cutting the plate member to which the semiconductor elements are adhered between adjacent semiconductor elements. Thereby, a semiconductor device in which a thinned semiconductor element is adhered to an integrated body can be easily and efficiently assembled.